US Army Corps of Engineers®
Engineer Research and Development Center

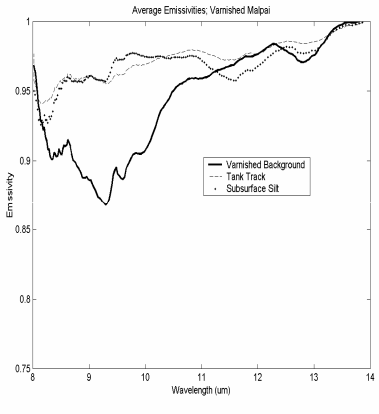
Vehicle Classification via Thermal Infrared Remote Sensing Strategy

Problem

Military planners often lack direct evidence of enemy vehicle strength or threat capability because, when remote data gathering is done, combat vehicles are commonly out of sight, either by camouflage or prior departure.

Description

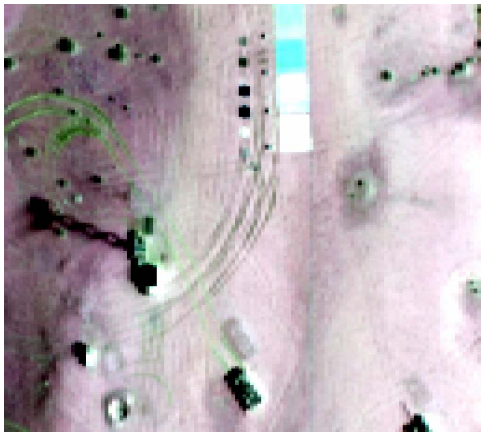
"Data signature analysis" in this context refers to a remote sensing strategy that discriminates between vehicles on the basis of indirect spectral evidence of surface disturbance, i.e., by examining their "tracks." A comparison of vehicles' tracks to known signature types can provide military planners with strategic information. Thermal signature analysis of surface track impressions created by vehicle/terrain interaction, for example, may enable evaluation of enemy vehicle strength or threat capability when the vehicles themselves are no longer in sight.



Emissivity signatures of vehicle tracks and background associated with images below.

This research is exploring the correlation between vehicles and their track-signatures, which may be exploited to discriminate between vehicle types. To develop this correlation, track thermal signatures were determined in conjunction with operation of a variety of vehicle types over six different soils at the Geotechnical and Structures Laboratory (GSL), Vicksburg, MS, Yuma Proving Grounds (YPG), AZ, and Redstone Arsenal, AL. Steel-tracked and rubber-tired vehicles were found to create distinctive track signatures in a variety of terrain types. Vehicle track renditions predicted by ground-level spectral measurements at YPG (above) are borne out in thermal imagery (below). The thermal image (right) readily differentiates between otherwise indistinguishable tank tracks and rubber-tired service vehicles tracks (left).

Tank tracks here are indistinguishable from those of rubber-tired service vehicles.



This thermal image shows steel-tracked tanks as green; rubber-tire tracks as gray.

Expected Products

This research will produce a library of spectral data to assist in battlefield analysis.

Potential Users

Products derived from this research will prove useful to military image interpreters tasked with gathering information about enemy vehicle strength/capability in the absence of direct visual evidence.

Projected Benefits

Data signature analysis expands intelligence capabilities by extending the useful interpretations that can be drawn from remotely gathered data. The strategy can help unveil potential threat capabilities posed by enemy vehicles on the basis of indirect evidence, and expose enemy weaknesses where no threats exist (e.g., where decoys have been deployed). This information may also help in battlefield targeting by distinguishing between actual threat vehicles and spectrally/visually identical decoys.

Project Manager

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Participating ERDC Laboratories

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